

RARE AND ENDANGERED PLANTS OF  
NEW HAMPSHIRE:  
A PHYTOGEOGRAPHIC VIEWPOINT<sup>1</sup>

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The native vascular plant flora of New Hampshire is estimated at about 1500 species (Hodgdon, 1973). We regard a total of 398 taxa as sufficiently rare in the state to warrant their protection through habitat preservation, and have enumerated them in our listing of New Hampshire's rare and endangered vascular plants (Storks & Crow, 1978). Of those listed, 144 taxa (36% of list, about 9% of native flora) are considered "endangered," 116 taxa (29% of list, about 8% of flora) "threatened," 127 taxa (32% of list, about 8% of flora) "rare" and 11 taxa (3% of list, about 1% of flora) possibly extinct.

Rare plant species of New Hampshire can be divided into 5 general categories based on distributional patterns within the state: (1) southern New Hampshire, (2) coastal taxa, (3) taxa primarily restricted to the Connecticut River Valley, (4) those of rare, somewhat scattered occurrence in the state, and (5) taxa adapted to the alpine environment of the White Mountains.

**Southern New Hampshire**

Over 100 taxa of the state's rare and endangered flora have been found to reach the northern or northeastern limit of their geographical range in the southern portion of the state. A number of taxa, such as *Desmodium marilandicum* (Tick-trefoil), *D. rigidum*, *D. rotundifolium*, *Lespedeza procumbens* (Trailing Bush-clover), *L. virginica*, and *Tephrosia virginiana* (Hoary Pea), are found in dry, open woods and slopes. Jeremy Hill in Pelham and the middle summit of the Pawtuckaway Mountains in Nottingham, sites which afford a warm, protected, southern exposure and are too rocky and steep for cultivation, serve as suitable sites for a number of such southern taxa.

*Isotria verticillata* (Whorled Pogonia), a plant of moist or dry acid woods, has been reported from only three stations in southern New Hampshire. *Isotria medeoloides* (Small Whorled Pogonia),

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<sup>1</sup>Scientific Contribution Number 1000 from the New Hampshire Experiment Station



which is extremely rare throughout its geographical range and was under review for federal "threatened" status (Federal Register, 1 July 1975, Vol. 40, No. 127), has been reported from six New Hampshire stations in rich hardwood forests. Both species are difficult to distinguish from *Medeola virginiana* (Indian Cucumber) when lacking flowers.

*Lilium superbum* (Turk's-cap Lily) is represented in New Hampshire by a single station at the edge of a saltmarsh along the Oyster River estuary in Durham. This station marks the northeastern limit of its geographical range.

Table 1 lists taxa of the rare and endangered flora which reach their northern or northeastern range limits in southern New Hampshire (excluding taxa restricted to coastal sites or the Connecticut River Valley).

Table 1. Southern N.H. (excluding coastal and Conn. R. V.)

EXTINCT ?	<i>Lygodium palmatum</i>
<i>Carex woodii</i>	<i>Panicum longifolium</i>
<i>Prenanthes serpentaria</i>	<i>Panicum sphaerocarpon</i>
	<i>Parietaria floridana</i>
ENDANGERED	<i>Parietaria pensylvanica</i>
<i>Arisaema dracontium</i>	<i>Pycnanthemum incanum</i>
<i>Aureolaria pedicularia</i> var. <i>intercedens</i>	<i>Pycnanthemum torrei</i>
<i>Bidens laevis</i>	<i>Ranunculus ambigens</i>
<i>Carex aestivalis</i>	<i>Ranunculus fascicularis</i>
<i>Carex flaccosperma</i> var. <i>glaucodea</i>	<i>Rhododendron periclymenoides</i> (=R. <i>nudiflorum</i> )
<i>Carex polymorpha</i>	<i>Rubus cuneifolius</i>
<i>Carex seorsa</i>	<i>Sericocarpus linifolius</i> (=Aster <i>solidagineus</i> )
<i>Cardamine bulbosa</i>	<i>Sphenopholis obtusata</i>
<i>Castilleja coccinea</i>	<i>Viola palmata</i>
<i>Desmodium marilandicum</i>	
<i>Desmodium rigidum</i>	
<i>Eragrostis frankii</i>	
<i>Eupatorium sessilifolium</i>	
<i>Isoetes foveolata</i>	THREATENED
<i>Isotria medeoloides</i>	<i>Acalypha virginica</i>
<i>Isotria verticillata</i>	<i>Arabis canadensis</i>
<i>Juncus platyphyllus</i>	<i>Asclepias purpurascens</i>
<i>Lechea tenuifolia</i>	<i>Asclepias quadrifolia</i>
<i>Lespedeza virginica</i>	<i>Aster patens</i> var. <i>patens</i>
<i>Lespedeza procumbens</i>	<i>Betula nigra</i>
<i>Lilium superbum</i>	<i>Bromus kalmii</i>
<i>Liparis lilifolia</i>	<i>Carex sparganioides</i>



Table 1 (continued)

THREATENED, continued	RARE
<i>Cyperus houghtonii</i>	<i>Anemonella thalictroides</i>
<i>Dentaria laciniata</i>	<i>Arabis missouriensis</i>
<i>Desmodium cuspidatum</i>	<i>Asclepias amplexicaulis</i>
<i>Desmodium rotundifolium</i>	<i>Asclepias tuberosa</i>
<i>Digitaria filiformis</i>	<i>Aureolaria virginica</i>
<i>Galium obtusum</i> var. <i>obtusum</i>	<i>Carex retroflexa</i>
<i>Galium pilosum</i>	<i>Cassia hebecarpa</i>
<i>Gentiana quinquefolia</i>	<i>Cenchrus longispinus</i>
<i>Geranium carolinianum</i> var. <i>carolinianum</i>	<i>Chimaphila maculata</i>
<i>Glyceria acutiflora</i>	<i>Convolvulus spithameus</i>
<i>Hemicarpha micrantha</i>	<i>Gentiana crinita</i>
<i>Hypericum adpressum</i>	<i>Hypoxis hirsuta</i>
<i>Isoetes eatoni</i>	<i>Iris prismatica</i>
<i>Isoetes engelmanni</i>	<i>Juncus secundus</i>
<i>Isoetes riparia</i> var. <i>riparia</i>	<i>Leptoloma cognatum</i>
<i>Lemna valdiviana</i>	<i>Lycopus rubellus</i>
<i>Muhlenbergia sobolifera</i>	<i>Nuphar advena</i>
<i>Muhlenbergia tenuiflora</i>	<i>Panicum philadelphicum</i>
<i>Polygonum tenue</i>	<i>Tovara virginiana</i>
<i>Rhododendron viscosum</i>	<i>Viola pedata</i> var. <i>lineariloba</i>
<i>Scirpus lineatus</i>	<i>Vulpia octoflora</i> var. <i>tenella</i>
<i>Solidago odorata</i>	<i>Woodsia obtusa</i>
<i>Tephrosia virginiana</i>	<i>Xanthoxylum americanum</i>
<i>Triphora trianthophora</i>	<i>Xyris torta</i>

### Coastal New Hampshire

The coastline of New Hampshire is transitional between the sandy beaches and barrier beach islands with extensive saltmarsh development, characteristic of the South to Middle Atlantic, and the rocky coastline characteristic of the North Atlantic. Although the linear shoreline is a mere 19 miles long, the shoreline of the Great Bay estuarine system is extensive, with several sites along the Piscataqua River having features characteristic of the open coast (Reynolds & Mathieson, 1975). Tidal marshes occupy approximately 7500 acres of the seacoast area (Breeding et al., 1974). A total of 37 taxa of New Hampshire's rare plants are coastal.

In North America *Sagina nodosa* ssp. *nodosa* (var. *pubescens* of Gray's Manual (Fernald, 1950)) is restricted to coasts, growing in



moist rock crevices along seashores and on sea cliffs from Cape Ann, Massachusetts to Nova Scotia (Crow, 1978). Several specimens were collected by Oakes and Robbins on the Isles of Shoals in the 1800's, but apparently the taxon has not been collected there since, and we regard it as probably extinct in the state.

The coastal region has experienced a continuing intense pressure from development interests. The only recorded site for *Diplachne maritima* (Salt-meadow Grass), a saltmarsh in the town of Seabrook, has been destroyed by development. Seabrook is also the location of a number of state rarities represented by a single New Hampshire station. Most of these are plants of the dune community. Because of coastal development, the foredune and interdune have been replaced by houses and summer cottages and only a remnant of the backdune remains. Several species, such as *Hudsonia tomentosa* var. *tomentosa* (False Heather), *Aristida tuberculosa* (Needlegrass), *Arenaria peploides* var. *robusta* (Seabeach Sandwort), *Cyperus grayii* (Sedge), and *Ammophila brevilgolata* (Beach Grass) occupy this site and their doom is heralded by a large sign announcing "Coming Soon, New Homes."

In contrast, *Iva frutescens* var. *oraria* (Shrubby Marsh-elder), which grows on shores and the upper margins of saltmarshes, appears to be extending its range northward.

Table 2 lists taxa restricted to coastal sites in New Hampshire.

An interior locality which has very strong Coastal Plain affinities is Ossipee Lake, which has very sandy beaches. Hellquist (1971) notes that the southern shore, known as Long Sands, consists of a particularly fine white sand on the shore and in the water, with intermittent "islands" of reeds along the shoreline. Here we have found *Hudsonia tomentosa* var. *intermedia* (False Heather) growing scattered along the entire stretch of beach. *Lycopodium inundatum* var. *bigelovii* (Bigelow's Bog Clubmoss) and *Proserpinaca pectinata* (Mermaid-weed), two additional rarities, grow among the reeds in a sandy-peaty substrate. A dominance of *Pinus rigida* (Pitch Pine) and *Quercus marilandica* (Scrub or Bear Oak) in the adjacent wooded areas is also reminiscent of Coastal Plain vegetation.

### Connecticut River Valley

While soils throughout the Granite State are predominately acidic, the alluvial soils of the Connecticut river floodplain and river



Table 2. Coastal New Hampshire

EXTINCT?	THREATENED
<i>Diplachne maritima</i>	<i>Ammophila breviligulata</i>
<i>Elymus mollis</i>	<i>Lilaeopsis chinensis</i>
<i>Sagina nodosa</i> ssp. <i>nodosa</i>	<i>Lycopodium inundatum</i> var. <i>bigelovii</i>
<i>Triplasis purpurea</i>	<i>Polygala cruciata</i> var. <i>aquilonia</i>
ENDANGERED	<i>Polygonum exsertum</i>
<i>Arenaria peploides</i> var. <i>robusta</i>	<i>Polygonum prolificum</i>
<i>Aristida tuberculosa</i>	<i>Potentilla pectinata</i>
<i>Aster tenuifolia</i>	<i>Salicornia bigelovii</i>
<i>Chenopodium rubrum</i>	<i>Samolus parviflorus</i>
<i>Cirsium horridulum</i>	<i>Woodwardia areolata</i>
<i>Cyperus grayii</i>	
<i>Eleocharis halophila</i>	
<i>Hudsonia tomentosa</i> var. <i>tomentosa</i>	
<i>Limosella subulata</i>	RARE
<i>Melampyrum lineare</i> var. <i>pectinata</i>	<i>Agalinis maritima</i>
<i>Rumex pallidus</i>	<i>Artemisia caudata</i>
<i>Salicornia virginica</i>	<i>Chamaecyparis thyoides</i>
<i>Scirpus robustus</i>	<i>Eleocharis parvula</i>
<i>Sclerolepis uniflora</i>	<i>Iva frutescens</i> var. <i>oraria</i>
<i>Sporobolus cryptandrus</i>	<i>Puccinellia paupercula</i>
<i>Triosteum aurantiacum</i>	<i>Spartina caespitosa</i>

terraces tend to be neutral to slightly alkaline from the deposition of silty materials derived from calcareous outcroppings upstream (Latimer et al., 1939; Williams et al., 1943). The floodplain and terraces tend to support moist, rich woods and meadows with a flora somewhat different from the rest of the state (Hodgdon & Steele, 1958). A total of 60 taxa on the New Hampshire list of rare and endangered plants are primarily restricted to the Connecticut River Valley.

*Orchis spectabilis* (Showy Orchis) is known from only 10 sites in New Hampshire, 8 of which occur along the Connecticut River, primarily on steep slopes of the river terraces supporting rich, calcareous woods. Indicator plants include *Hepatica acutiloba* (Hepatica), *Asarum canadensis* (Wild Ginger), *Adiantum pedatum* (Maidenhair Fern), and *Caulophyllum thalictroides* (Blue Cohosh) (F. E. Brackley, pers. comm.).

Two orchids reported from the town of Hanover are of particular interest. *Habenaria ciliaris* (Orange-fringed Orchis), represented by



a single New Hampshire station, was last collected in 1872 and is now believed to be extinct. *Cypripedium reginae* (Showy Lady's-slipper) was documented from a bog, known as the Bottomless Pit, in 1889, 1890 and 1891, but apparently has not been collected since. The bog is now in the late stages of succession, the open water stage long since passed, and extinction may have been a natural process for this orchid population.

We reported the Hanover station of *Cypripedium reginae* as the single documented station in New Hampshire and probably extinct for the state (Storks & Crow, 1978). During the summer of 1979, F. E. Brackley (1979) located and documented two new stations, one in the town of Lyme and another in the town of Lisbon. This underscores the need for additional field work on the modern status of rare and endangered plants.

Lime Pond in Columbia is located in a calcareous area characterized by bedrock composed of mica schist impregnated with calcareous materials and bands of impure silicious limestone (Pease, 1964). It is one of two documented sites for the exceedingly rare *Calypso bulbosa* (Calypso orchid). This locality, in a wet *Thuja occidentalis* (Northern White Cedar) woods, was discovered in 1934 by T. W. Wallace (letter accompanying photographic specimen in the Hodgdon Herbarium, NHA) and last collected by A. S. Pease in 1946. The site was visited by Pease (1964) in 1952 and 1961, but the orchid was not found, nor were we able to locate it in 1978. A potential threat to the habitat surfaced in 1978 when the State of New Hampshire was approached for permission to mine the lime sediments, estimated at 300,000 tons, to sell to local farmers (Ferriter, 1978). Although the State denied the proposal, the economic value of the lime deposits on the bottom of the pond may pose a threat to the habitat in the future.

Table 3 lists taxa primarily restricted to the Connecticut River Valley.

### Scattered Distribution

A number of taxa are not restricted to a particular region of the state, but occur somewhat widely scattered. Availability of suitable habitat appears to be the primary factor influencing the distribution of these plants.

Several orchids fit this distributional pattern and may be declining due to the vulnerability of their habitats to development and



Table 3. Primarily restricted to Connecticut River Valley

EXTINCT?	Tofieldia glutinosa
Calypso bulbosa	Uvularia grandiflora
Habenaria ciliaris	Woodsia glabella
ENDANGERED	THREATENED
Acer nigrum	Allium schoenoprasum var. sibiricum
Amphicarpa bracteata var. comosa	Carex amphibola var. rigida
Aster ptarmicoides	Carex aurea
Astragalus alpinus var. brunetianus	Carex diandra
Astragalus robbinsii var. jesupi	Eleocharis pauciflora var. fernaldii
Carex buxbaumii	Hypericum pyramidatum
Carex castanea	Liparis loeselii
Carex garberi var. bifaria	Parnassia glauca
Collinsonia canadensis	Potamogeton richardsonii
Corydalis aurea	Salix interior
Cypripedium reginae	Solidago purshii
Dentaria maxima	RARE
Eleocharis nitida	Camptosorus rhizophyllus
Equisetum variegatum var. jesupi	Carex bebbii
Eragrostis hypnoides	Celtis occidentalis
Halenia deflexa	Cyperus inflexus
Heteranthera dubia	Cystopteris bulbifera
Juniperus horizontalis	Dicentra canadensis
Malaxis brachypoda	Dryopteris goldiana
Polygonatum commutatum	Equisetum pratense
Potamogeton filiformis	Hepatica acutiloba
Potamogeton foliosus	Hydrophyllum virginianum
Potamogeton lateralis	Juncus brachycephalus
Pycnanthemum virginianum	Lobelia kalmii
Ranunculus subrigidus	Sanicula gregaria
Rosa acicularis	Senecio pauperculus
Salix cordata var. abrasa	Staphylea trifolia
Spiranthes lucida	Viola rostrata

destruction. Examples include *Cypripedium calceolus* var. *pubescens* (Large Yellow Lady's-slipper) and var. *parviflorum* (Small Yellow Lady's-slipper), *Listera cordata* (Heartleaf Twayblade), and two which were under review for federal "threatened" status (Federal Register, 1 July 1975, Vol. 40, No. 127), *Habenaria (Platanthera) flava* var. *herbiola* (Pale Green Orchis) and *Cypripedium arietinum* (Ram's-head Lady's-slipper).

Another orchid of particular interest is *Triphora trianthophora* (Nodding Pogonia). This species occurs in nearly pure stands of *Fagus grandifolia* (American Beech) whose soils have a deep humus.



The plants may remain dormant underground for long periods (Lownes, 1920) and therefore may appear to be exceedingly rare in some years and locally abundant in others.

The caryophyllaceous *Paronychia argyrocoma* var. *albimontana* (White Mountain Silverling or Silver Whitlow-wort) occupies bare granitic slopes and ledges and occasionally sandy river banks. This restricted and local taxon, endemic to northern New England, was under review (Federal Register, 1 July 1975, Vol. 40, No. 127) for federal "threatened" status.

Suitable habitat for *Pinguicula vulgaris* (Butterwort), a boreal species of chiefly wet, calcareous sites, is very rare in the state, with only 3 localities known. The plants occupy wet rock cliffs and steep slopes of the Cannon Cliffs and Mt. Lafayette in Franconia, and Butterwort Flume in Crawford Notch, Hart's Location.

### Alpine Environment

The greatest number of taxa (80) listed as rare and endangered for a single habitat in New Hampshire are adapted to the alpine environment of the Presidential and Franconia Ranges of the White Mountains, chiefly Mt. Washington. A detailed account of the status of the rare and endangered alpine species has been given in a report prepared for the White Mountain National Forest, New Hampshire (Storks, 1979; Storks and Crow, 1979). Several sites and taxa are particularly noteworthy. Tuckerman's Ravine, the Great Gulf, and Huntington's Ravine of Mt. Washington are steep, cool, moist ravines in which great amounts of snow accumulate and remain long into the growing season. A number of plants adapted to arctic conditions occur in these locations.

*Sibbaldia procumbens* (Sibbaldia), disjunct from the Gaspé Peninsula, Quebec; the Long Range, Newfoundland; and arctic regions, occurs only in Tuckerman's Ravine and represents a single New England station.

*Oxyria digyna* (Mountain Sorrel) is known in northeastern United States only from the Great Gulf, Tuckerman's Ravine, and Huntington's Ravine on Mt. Washington.

Other arctic-alpine plants which occur chiefly in the cool, wet ravines and along alpine brooks include *Cardamine bellidifolia* (Alpine Cress), *Salix herbacea* (Dwarf Willow), *Arnica mollis* (Arnica), *Phleum alpinum* (Alpine Timothy), *Festuca prolifera* (Prolific Fescue), *Castilleja septentrionalis* (Pale Painted-cup), *Bar-*



*barea orthoceras* (Winter-cress), *Epilobium alpinum* (Alpine Willow-herb), *E. palustris* (Marsh Willow-herb), *E. hornmanni* (Hornmann's Willow-herb), and *Salix planifolia* (Tea-leaved Willow).

Two extremely rare saxifrages occupy moist ledges and cliffs of the headwall of Huntington's Ravine. *Saxifraga aizoon* var. *neogaea* (Live-long Saxifrage) was discovered in 1939 by Dr. John Churchill (1967), and relocated in 1967 (Steele, 1967), in a site accessible only to professional rock climbers. A second site of 30–40 plants was discovered by Irene Storks in 1978 on a ledge just 10 feet up the cliff. This is the only locality known for New Hampshire. Vermont (Countryman, 1978) and Maine (Eastman, 1978a) report the only other New England occurrences of the taxon.

*Saxifraga cernua* (Bulblet Saxifrage) was also discovered by Churchill at the time he first observed *S. aizoon* on the headwall of Huntington's Ravine (Churchill & Hodgdon, 1967). This site represents a single New England station.

Another Huntington's Ravine rarity is *Gnaphalium supinum* (Alpine Cudweed). It grows in unstable coarse gravels just beneath the headwall of the ravine and is therefore vulnerable to disturbance and possible extirpation by activities of hikers and climbers. The population last documented in Tuckerman's Ravine in 1901 by Eggleston appears to be extinct, perhaps as a result of trampling.

The most critically endangered alpine plant is the New England endemic *Potentilla robbinsiana* (Robbins' Cinquefoil). This species, previously believed to be endemic to New Hampshire, has recently been reported by Countryman (1978) from an understandably undisclosed site in Vermont. We have also recently discovered two additional historical records among an unmounted Robbins collection in the New England Botanical Club Herbarium. Both specimens were collected by Tuckerman, one from the north side of the peak of Mt. Washington (1839) and the other from Mt. Mansfield, Vermont (no date).

The original station for *Potentilla robbinsiana* remains the primary site of the species. Its location on the southwest slope of Mt. Washington is well known. The greatest threat to the population comes, not from naturalists wishing to see this rare endemic (although, admittedly, far too many specimens have been collected by our botanical forefathers), but from the cumulative effect of trampling by hikers over the years. Presently the Crawford Path



(part of the Appalachian Trail) passes right through the fragile alpine fellfield and several local botanists can remember when plants of *P. robbinsiana* grew on both sides of the trail (F. L. Steele, pers. comm.). The population has become constricted such that plants now occupy only 2/10ths of an acre and only approximately 1800 mature plants remain (Graber, 1980). Often hikers unknowingly wander across the critical site to reach a rock outcrop which affords a magnificent view from the upper rim of Oakes Gulf. The impact is severely altering the habitat by disturbing the stony surface and trampling individual plants, the seedlings being most sensitive (Graber, 1980).

The White Mountain National Forest staff are concerned about the protection of this population and steps are being taken, in cooperation with the Appalachian Mountain Club, to provide a greater measure of protection to the site.

Table 4 lists plants of the alpine and subalpine considered endangered, threatened or rare in New Hampshire.

#### PHYTOGEOGRAPHICAL AFFINITIES

The flora of New Hampshire, post-Pleistocene in age, is derived from a number of phytogeographic elements. Many of our species are rare because they are at the edge of their ranges, northern or southern, or are disjunct from areas where they occur in greater abundance and frequency. Some are rare throughout their entire range.

**Widespread/eastern United States element.** A large number of our rarities reach the northern or northeastern limit of their range in New Hampshire. Table 1 includes a list of plants of southern New Hampshire (exclusive of coastal taxa and taxa restricted to the Connecticut River Valley) which fit this pattern.

Major river systems, such as the Connecticut, Merrimack and Saco Rivers, have served as migratory routes by which some taxa have extended their range. *Celtis occidentalis* (Hackberry), for example, which occurs widely in eastern United States primarily in damp woods and alluvial soils, extends its range northward from southern New England into New Hampshire and Vermont along the Connecticut River Valley and into northern Vermont along the Hudson River Valley (Little, 1971). The pattern is similar for *Carya cordiformis* (Bitternut Hickory).

**Atlantic Coastal Plain element.** The Atlantic Coastal Plain provides



Table 4. **Alpine and subalpine New Hampshire**


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EXTINCT?	<i>Saxifraga rivularis</i>
<i>Calamagrostis nubila</i>	<i>Trisetum spicatum</i> var. <i>pilosiglume</i>
	<i>Veronica alpina</i> var. <i>unalaschcensis</i>
ENDANGERED	RARE
<i>Barbarea orthoceras</i>	<i>Agrostis borealis</i> var. <i>americana</i>
<i>Cardamine bellidifolia</i>	<i>Agrostis borealis</i> var. <i>borealis</i>
<i>Carex atratiformis</i>	<i>Arenaria groenlandica</i>
<i>Carex capillaris</i> var. <i>capillaris</i>	<i>Betula glandulosa</i>
<i>Carex capitata</i>	<i>Betula minor</i>
<i>Carex lenticularis</i> var. <i>albimontana</i>	<i>Calamagrostis canadensis</i> var. <i>robusta</i>
<i>Epilobium alpinum</i>	<i>Calamagrostis pickeringii</i> var. <i>debilis</i>
<i>Euphrasia oakesii</i>	<i>Calamagrostis pickeringii</i> var.
<i>Festuca prolifera</i>	<i>pickeringii</i>
<i>Gnaphalium supinum</i>	<i>Carex bigelowii</i>
<i>Luzula confusa</i>	<i>Carex scirpoidea</i>
<i>Oxyria digyna</i>	<i>Deschampsia atropurpurea</i>
<i>Poa alpigena</i>	<i>Diapensia lapponica</i>
<i>Potentilla robbinsiana</i>	<i>Empetrum atropurpureum</i>
<i>Salix peasei</i>	<i>Empetrum nigrum</i>
<i>Saxifraga aizoon</i> var. <i>neogaea</i>	<i>Epilobium ciliatum</i>
<i>Saxifraga cernua</i>	<i>Epilobium hornmanni</i>
<i>Sibbaldia procumbens</i>	<i>Epilobium palustre</i>
<i>Silene acaulis</i> var. <i>exscapa</i>	<i>Geocaulon lividum</i>
<i>Viola labradorica</i>	<i>Hierochloe alpina</i>
THREATENED	<i>Juncus trifidus</i>
<i>Achillea borealis</i>	<i>Loiseleuria procumbens</i>
<i>Arctostaphylos alpina</i>	<i>Luzula spicata</i>
<i>Arnica mollis</i>	<i>Lycopodium annotinum</i> var. <i>pungens</i>
<i>Calamagrostis lacustris</i>	<i>Lycopodium selago</i>
<i>Calamagrostis neglecta</i>	<i>Poa fernaldiana</i>
<i>Cassiope hypnoides</i>	<i>Poa glauca</i>
<i>Castilleja septentrionalis</i>	<i>Prenanthes trifoliolata</i> var. <i>nana</i>
<i>Geum peckii</i>	<i>Rhinanthus crista-galli</i>
<i>Houstonia caerulea</i> var. <i>faxonorum</i>	<i>Rhododendron lapponicum</i>
<i>Paronychia argyrocoma</i> var.	<i>Salix uva-ursi</i>
<i>albimontana</i>	<i>Scirpus cespitosus</i> var. <i>callosus</i>
<i>Phleum alpinum</i>	<i>Solidago cutleri</i>
<i>Phyllodoce caerulea</i>	<i>Spiraea latifolia</i> var. <i>septentrionalis</i>
<i>Polygonum viviparum</i>	<i>Vaccinium boreale</i>
<i>Prenanthes Boottii</i>	<i>Vaccinium uliginosum</i> var. <i>alpinum</i>
<i>Rubus chamaemorus</i>	<i>Vaccinium vitis-idaea</i> var. <i>minus</i>
<i>Salix argyrocarpa</i>	<i>Viburnum edule</i>
<i>Salix herbacea</i>	<i>Viola palustris</i>
<i>Salix planifolia</i>	

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another avenue of migration for a number of plants. Taxa such as *Ammophila breviligulata* (Beach Grass), *Aristida tuberculosa* (Needlegrass), *Chamaecyparis thyoides* (Atlantic White Cedar), *Cyperus grayii* (Sedge), *Hudsonia tomentosa* var. *tomentosa* (False Heather), *Polygonum robustius* (Robust Smartweed) and *Proserpinaca pectinata* (Mermaid-weed) serve as examples.

*Parietaria floridana* (Pellitory) in New Hampshire is somewhat of a puzzle. The taxon is clearly a Coastal Plain species in southeastern United States, occupying maritime forests from Florida to Texas, and north to North Carolina on the outer Coastal Plain (Small, 1933; Radford et al., 1968; Correll & Johnston, 1970). However, the species occurs westward to Arizona and southern California in non-coastal sites (Kearney & Peebles, 1964; Munz & Keck, 1970). It occurs in a disjunct locality in New Hampshire, not on the coast, but on Mt. Pawtuckaway (elevation 1,011 ft.) in Nottingham, Rockingham County. It is possible that this species was more widespread during the post-glacial warming trend which reached a temperature maximum between 5000 and 8000 years ago (Wright, 1972) and that the Mt. Pawtuckaway station may represent a relict population. It has not been collected since A. A. Eaton's discovery in 1896.

**Northern coastal element.** This phytogeographic unit is represented by only a few of our rare species. These include *Elymus mollis* (Sea Lyme-grass), *Puccinellia paupercula* (Alkali-grass), and *Sagina nodosa* ssp. *nodosa* (Pearlwort).

**Cordilleran element.** Several taxa of the flora of New Hampshire belong to a Cordilleran element, disjunct from the montane regions of western North America. Of those taxa listed as rare and endangered in New Hampshire, *Arnica mollis* (Arnica), a disjunct from the alpine and subalpine regions of western North America, and *Osmorhiza chilensis* (Sweet Cicely), a woodland plant, fit this distributional pattern.

**Circumboreal element.** Several of our rare species range widely around the world in the boreal forest region. *Calypso bulbosa* (Calypso), *Equisetum palustre* (Horsetail), *Hieracium umbellatum* (Hawkweed), and *Listera cordata* (Heart-leaved Twayblade) are examples of this distribution pattern.

**Circumpolar element.** A large number of arctic-alpine disjuncts are distributed widely around the polar regions of the Northern Hemisphere. Examples include: *Arctostaphylos alpina* (Alpine Bear-



berry), *Cardamine bellidifolia* (Alpine Cress), *Carex capitata* (Capitate Sedge), *Epilobium alpinum* (Alpine Willow-herb), *Loiseleuria procumbens* (Alpine Azalea), *Lycopodium annotinum* var. *pungens* (Bristly Clubmoss), *Oxyria digyna* (Mountain Sorrel), *Phleum alpinum* (Alpine Timothy)—a bipolar disjunct, *Salix herbacea* (Dwarf Willow), *Saxifraga cernua* (Bulblet Saxifrage), and *Saxifraga rivularis* (Alpine-Brook Saxifrage).

**North American element—transcontinental in the boreal forest region.** Species representing this element include: *Achillea borealis* (Northern Yarrow), *Geocaulon lividum* (Northern Comandra), *Juniperus horizontalis* (Creeping Savin), *Listera convallarioides* (Broad-lipped Twayblade), *Pinus banksiana* (Jack Pine), and *Viburnum edule* (Mooseberry).

**North American element—transcontinental at high latitudes.** Several of our arctic-alpine disjuncts comprise this element: *Castilleja septentrionalis* (Pale Painted-cup), *Saxifraga aizoon* var. *neogaea* (Live-long Saxifrage), and *Vaccinium vitis-idaea* var. *minus* (Mountain Cranberry).

**Northeastern North American element.** Arctic-alpine examples of this group include: *Arenaria groenlandica* (Mountain Sandwort), *Betula minor* (Dwarf Birch), *Empetrum atropurpureum* (Purple Crowberry), *Juncus trifidus* (Three-forked Sedge), *Salix uva-ursi* (Bearberry Willow), and *Vaccinium boreale* (Northern Blueberry). Plants of lower elevations include: *Listera auriculata* (Auricled Twayblade), *Malaxis brachypoda* (Adder's Mouth), and *Myriophyllum farwellii* (Farwell's Water-Milfoil).

**Amphi-Atlantic element.** Several of our arctic-alpine plants have an Amphi-Atlantic distribution, their range including both sides of the Atlantic. Examples are *Carex bigelowii* (Bigelow's Sedge), *Cassiope hypnoides* (Moss Plant), *Diapensia lapponica* (Diapensia), *Festuca prolifera* (Prolific Fescue), *Rhododendron lapponicum* (Lapland Rosebay) and *Silene acaulis* var. *exscapa* (Moss Campion).

**Endemic element.** The endemic element, as one might expect for a recently derived flora in a region completely denuded of vegetation by glacial action, consists of just a few taxa. Endemics which occur in New Hampshire include the following:

*Prenanthes boottii* (Boott's Rattlesnake-root) is restricted to alpine areas in New York, Vermont, New Hampshire, and Maine. The center of distribution appears to be the White Mountains of



New Hampshire, where Pease (1964) considered the species to be common in the alpine zone. The species is known from 3 stations in Maine (Eastman, 1978a), 2 sites in Vermont (Countryman, 1978) and 3 localities in New York (Mitchell, 1979).

*Paronychia argyrocoma* var. *albimontana* (White Mountain Silverling or Silver Whitlow-wort) is likewise primarily distributed in New Hampshire, where it is documented from 19 sites, growing principally on dry, rocky ledges. Eastman (1978b) cites 8 stations in Maine, and a single station is known from Massachusetts on rocky ledges of an island in the Merrimack River (Coddington & Field, 1978).

*Houstonia caerulea* var. *faxonorum* (Alpine Bluet) has a very restricted overall distribution. It occupies meadows and stream margins of alpine and subalpine areas in the Presidential range of the White Mountains, New Hampshire, and along stream borders in the French Territory of St. Pierre et Miquelon, off the southern coast of Newfoundland. This taxon differs from the typical variety on very minor characters and a review of its taxonomic status is in order.

*Geum peckii* (Mountain Avens) occurs in great abundance in moist alpine meadows and subalpine ravines throughout the Presidential and Franconia Ranges of New Hampshire. It is also occasionally found growing on wet rocks in openings at lower altitudes in Coos and Grafton Counties. The species is known only from the White Mountains in New Hampshire and in Nova Scotia from a large bog on Brier Island, Digby County (Roland & Smith, 1969) and two new sites, Cumberland and Pictou Counties (Scoggan, 1978). The species is most closely related to *Geum radiatum*, a rare endemic of balds at upper elevations in North Carolina (Raynor, 1952; Gajewski, 1957).

*Potentilla robbinsiana* (Robbins' Cinquefoil) is our rarest endemic, with only 2 populations believed to be extant in New England, the primary site located on the southwestern slope of Mt. Washington and the small station newly reported by Countryman (1978) in Vermont. Löve and Löve (1966) regard the taxon as an apomictic segregate of the arctic *P. hyparctica* and treat the arctic taxon as *P. robbinsiana* ssp. *hyparctica* (D. Löve, 1968).

#### CONCLUSIONS

A complex interrelationship involving environmental, biotic, physical, and historical factors has come to bear on the develop-



ment of the rare components of the flora of New Hampshire. Of the estimated 1500 native vascular plant species comprising the flora, about 9% are endangered, about 8% are threatened, about 8% are rare and about 1% are possibly extinct. The rare component of the flora appears to consist of 11 phytogeographical groups: Widespread/eastern United States element, Atlantic Coastal Plain element, Northern coastal element, Cordilleran element, Circumboreal element, Circumpolar element, North American Element—transcontinental in the boreal forest region, North American element—transcontinental at high latitudes, Northeastern North American element, Amphi-Atlantic element, and the Endemic element.

#### ACKNOWLEDGMENTS

We wish to thank Drs. A. Linn Bogle and Larry E. Morse for their helpful comments on the manuscript. Special thanks go to Mr. Richard Dyer and the U.S. Fish and Wildlife Service for their generous support in making possible this symposium, "Rare and Endangered Plant Species in New England."

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